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SERVICIO DE ESTUDIOS

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Abstract

This paper examines the dividend policies of firms in Spain. Using firm-level panel data, models are estimated for dividend omissions as functions of financial characteristics, whilst also considering a role for persistence. The results are consistent with a tax discrimination model in which cash flow is the marginal source of funds. High degrees of persistence are also found in binary panel data models that control for unobservables and initial conditions. Whilst companies in Spain use the dividend to adjust the balance sheet, such persistence suggests this occurs slowly.

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Key Words: Dividends; financial pressure; discrete panel.

1 Introduction

Dividends, whilst having long been a preoccupation in the financial economics literature, also remain relatively poorly understood.[1] In order to help understand the determination of corporate dividend policies, in this paper the basic decision for a company of whether to pay a dividend or not is examined using firm-level data for Spain.

The paper focuses on tax issues, or more generally a resulting financial hierachy, as providing the economic background for the econometric analysis drawing on the tax discrimination model originating in King (1977) and Auerbach (1979) (see also Auerbach, 2001). A number of hypotheses regarding the determination of dividends follow from this approach. The further notion that dividends may be slow to adjust has been emphasised since the classic study of Lintner (1956) who suggested that companies aimed to set the dividend at a sustainable level owing to an aversion to cutting the dividend. This implies persistence in company-level dividend policies. Obtaining an accurate estimate of the degree of persistence in a company's propensity to omit or pay a dividend is, however, complicated by the presence of unobserved heterogeneity and the likely presence of an initial conditions problem whereby this unobserved heterogeneity is itself correlated with the initially observed policy of the firm to pay a dividend or not. The econometric analysis in the present paper pays special attention to controlling for such unobserved heterogeneity and initial conditions.

The setting of dividend policies is also considered in the context of how companies respond to financial pressure. To what extent does financial pressure, intended to capture the premium on borrowing costs or the probability that credit will be rationed completely, influence the probability that a firm will pay a dividend to its shareholders? Nickell and Nicolitsas (1999) address how companies respond to such financial pressure in the form of their employment decisions, wage settlements and productivity growth. Potentially, the decision to omit a dividend offers a means for the company to help insulate its real decisions from financial pressure effects. The paper therefore extends the analysis of Nickell and Nicolitsas (1999) concerning firm behaviour in response to financial pressure to include the dividend payment decision.

The main aims of the paper, therefore, are the following. First, to consider the congruency of dividend policies with the implications of the tax discrimination model. In so doing, the paper provides the first panel study of the propensity for Spanish firms to omit a dividend. Second, to consider the persistence of dividend policies, following Lintner (1956), whilst controlling for unobservables and initial conditions at the company-level. Third, to estimate how the experience of financial pressure by a firm influences its probability of omitting a dividend.

The remainder of the paper is organised as follows. Section 2 summarises the theoretical background to the study of dividends, in the form of a tax discrimination model of financial policies. Section 3 describes the estimation methods whilst section 4 describes the panel data set of Spanish companies, drawn from the Central de Balances of the Banco de España, and presents the estimation results. Section 5 concludes.

2 Economic background

A number of approaches, summarised in Allen and Michaely (1995), have been suggested to reconcile observed practice, and the attention devoted to dividend payments, with the implication under the conditions of Miller and Modigliani (1961), that dividend policies are unimportant for the valuation of a company. Rather than provide an encompassing treatment of these issues, this section focuses on describing the implications of tax issues using the 'new view' model of taxation and corporate finance. This provides a rationale for a hierarchy of finance based on tax considerations which has been used as a basis to previous studies of dividends for UK firms (eg. Bond *et al.* 1996, Benito and Young, 2001) and US firms (Auerbach and Hassett, 2002).

The so-called 'new view' model of corporate taxation originated in the work of King (1977), Auerbach (1979) and Bradford (1981), with a recent statement of the model being Auerbach (2001).[2] According to the new view, the optimum level of dividends is chosen jointly with fixed investment and its financing to maximise the value of corporate equity. In the absence of taxes, the model would be consistent with the Modigliani-Miller propositions about the irrelevance of debt and dividend policy to firm values. Tax discrimination gives rise to a hierarchy of funds where internal funds provide the marginal source of finance owing to differences in the tax treatment of capital gains versus income tax and owing to the costs of issuing new equity.

Slightly more formally, the financial policies of firms are determined by the tax discrimination parameter (King, 1977) in the following way. For a given investment programme, a new share issue generates dividends of $(1-f)/(1-c)$ for every unit issued, where f denotes the cost of issuing equity and c is the rate of imputation or credit received by shareholders against dividend income. This reveals the degree of integration of the corporate and personal tax systems. Extra dividends raise the value of equity by $\delta = (1-\tau^p)(1-f)/(1-c) - 1$, where $(1-\tau^p) = \frac{(1-\tau^m)}{(1-g^m)}$ with τ^m the personal marginal tax rate, and g^m the personal capital gains tax rate.[3] If $\delta > 0$, then shareholders gain from higher dividends financed by new issues. Under the Spanish tax system where the imputation rate c was zero until 1978 (a "classical system" which does not offer any correction against 'double taxation' of dividends and has also traditionally operated in the United States) this expression was negative even in the absence of costs of new equity ($f = 0$) since the marginal rate of income tax exceeded that on capital gains, that is $(1-\tau^p) < 1$. The existence of equity issuance costs, both direct and those arising from information asymmetries will further exacerbate this preference for internal funds being the marginal source of funds.[4] This means that under the classical system it would never have been optimal for Spanish companies to make dividend payments *and* raise new equity since this incurs a tax liability which could be avoided by not paying dividends.[5] Developments in the Spanish tax system since 1978 have generally reduced the tax discrimination against dividends in an attempt to offset double taxation of dividends, but not eliminated it entirely.

Since 1978, individual shareholders have received some tax credit to offset the tax paid at the corporate level. This tax offset against double imposition was initially introduced at the rate $s = 0.15$ where $(1+s) = (1-c)^{-1}$, and s is the rate of credit for shareholders for each unit of dividends received. This rate s was then reduced marginally to 0.10 in 1985 but in a more significant change in 1995 was increased to 0.40, thereby significantly reducing the tax cost of dividends (see for example, Fonseca-Chacharo, 1997).

To take a specific example, consider the case in 2002 where the rate of capital gains tax, $g^m = 0.18$ and a marginal rate of income tax of $\tau^m = 0.48$ for higher rate tax payers. With the correction for double imposition, $s = 0.40$, then assuming a conservative fixed cost of equity issuance of $f = 0.10$, the tax discrimination parameter becomes $\delta = -0.20$, indicating a tax preference for retained funds to be the marginal source of funds with dividend distributions being minimised. Of course the relevant tax parameters have changed through time but it has generally been the case that the rate of capital gains tax has been less than the marginal rate of income tax suggesting that $(1 - \tau^p) < 1$.[6] Other combinations of parameters may give rise to a preference for equity issuance and dividend income, particularly for lower rate marginal tax payers, that recive the offset against double imposition. For instance, in the example above, this would be the case for investors for whom the marginal rate of tax $\tau^m \leq 0.35$. In the case of investors such as institutions that are tax-exempt any issuance costs will be sufficient to provide a tax discrimination case against issuing equity, since these do not receive the offset against double imposition.

A key prediction of the new view is that mature companies that have sufficient internal funds to finance profitable investment opportunities, obtain funds for investment through the retention of earnings, without issuing additional equity and distribute residual funds as dividends, even when the tax system discriminates against dividends (Auerbach and Hassett, 2002). This largely arises from the lack of other feasible tax-efficient ways of distributing funds to shareholders. Dividends are effectively paid out of residual cash flows since there would be no better use for the available funds. The cost of capital would be independent of dividend taxes since these have an offsetting effect on the net outlay and return on investment (Auerbach, 2001). However, cash poor 'immature' companies, unable to pay negative dividends, would have a higher cost of capital reflecting the higher cost of new equity finance that comes about because there is no dividend income tax saved on the outlay on investment while the subsequent return will ultimately be taxed. This higher cost of capital would be reflected in a lower rate of investment for given investment opportunities. As such the cost of capital is higher and investment spending lower than it would have been had the firm's cash flow been stronger. These firms are described as financially constrained in the closely related model of Bond and Meghir (1994) which is based on the same tax considerations applied to UK firms.[7]

Empirical Implications of the Model

As stated, the model provides a framework for an empirical investigation of dividend behaviour. The purpose of this discussion is not to exploit tax variation as a source of identification to test the model. This is partly because the approach does not point to a particular equation that could be estimated as this depends on relative taxes and which constraints are binding. Nevertheless, a range of factors are expected to affect the dividend payment and the choice of whether to pay a dividend at all. These include measures of profitability or cash flow, investment and indebtedness.[8] In summary, the following predictions emerge from the model:

- Generally, dividends would be paid only when there is no cheaper way of distributing cash to shareholders. Companies would not raise new equity capital and pay dividends at the same time. Companies with large cash flow relative to investment are less likely to omit dividends because of the absence of more tax efficient means of returning cash to shareholders.

- An implication highlighted by Auerbach and Hassett (2002) is that as residual cash flows should vary in order to act as the marginal source of funds for investment this should mean an inverse relation between dividends paid and investment. This translates into a positive relation between the propensity to omit the dividend and the investment of the firm.

- In the short term, an increase in indebtedness could finance an increase in dividends, but in the longer run a higher level of debt will be associated with higher interest payments and lower dividends. Changes in dividend payments are ultimately the main means by which companies can adjust their balance sheets leading to a positive relation between the debt of the company and the propensity to omit the dividend.

In addition, a range of other factors, not included explicitly within the model, are likely to be important:

- Inertia to corporate dividend behaviour, under the well-known argument of Lintner (1956).[9] Partial adjustment reflects the preference for companies to maintain the dividend at what they believe to be a sustainable level.

- Following Nickell and Nicolitsas (1999), a term for the financial pressure associated with servicing debt may also be important. Nickell and Nicolitsas (1999) add this borrowing ratio term (the ratio of interest payments to cash flow) to standard models for employment, wages and productivity growth to examine how financial pressure affects firm behaviour. Along similar lines, a role for this variable in increasing the propensity for a firm to omit the dividend might be expected. In the analysis of Nickell and Nicolitsas (1999) this variable picks up the premium on borrowing costs or the probability of credit being rationed completely. The case for the flow borrowing ratio as the appropriate measure of financial pressure is based on demonstrating its relation with corporate net worth (see Nickell and Nicolitsas, 1999) and the observation that in practice bankers attach considerable importance to this measure of financial health, with contracts sometimes including covenants expressed in terms of this variable or its reciprocal, the coverage ratio.[10]

- According to some arguments, agency problems and issues of signalling are expected to be more important for larger firms suggesting that firm size may be related to dividend behaviour, for a given financial situation. Small firms might also put less weight on dividend signals if there is a high fixed cost of state verification.

The model as described has not taken account of a number of additional factors. These include the possibility that effective governance institutions might lessen the need for dividends as a disciplining device. These factors, and others, suggest that there is likely to be an important role for unobserved heterogeneity in determining the propensity for companies to omit a dividend. The estimation approach described below is designed to control for such factors.

A natural question concerns the extent to which this framework can be applied to unquoted as well as quoted companies. The majority of firms in the dataset for Spain that will be considered are unquoted. Unquoted companies cannot raise new equity finance on a publicly traded market. They can and do, however, offer new equity stakes to individual or group investors, to whom it is common practice to pay a dividend. To the extent that the raising of new equity finance is more expensive for unquoted companies then this could imply a correspondingly higher value for the cost of raising equity, f. It also seems reasonable to assume that such companies maximise the value of that share capital since even though they are not subject to the discipline of a takeover market, management in unquoted companies typically have a larger direct equity stake in the company. This suggests that the applicability of the model may well carry over to the analysis of unquoted companies, though this might also be thought an empirical question.

There exist a number of previous studies of dividend policies among Spanish firms. Arrazola *et al.* (1992) examine dividend distributions in a cross-sectional sample of 617 firms drawn from the Central de Balances database. Tobit models for the level of dividend are estimated, and include significant roles for profits, investment and a lagged dependent variable. The inclusion of the lagged dependent variable makes no attempt to control for unobserved heterogeneity or initial conditions, both key concerns of the analysis below and may therefore simply be picking up such unobserved heterogeneity.

A study by Giner-Bagüés and Salas-Fumás (1995) considers the dividend policies of quoted Spanish firms. The paper highlights the Lintner (1956) hypothesis of persistence in dividend distributions and looks for asymmetries in this persistence between companies where profits have risen and those that have experienced a reduction in profits. One weakness of the Giner-Bagüés and Salas-Fumás (1995) analysis is that they select firms that at some point in the sample period have paid a dividend. Since a large proportion of those that omit a dividend, never make a dividend payment (see below), this selects out a significant proportion of firms and is unlikely to be a random selection. In contrast, the analysis below focuses on this propensity to omit a dividend and on persistence in this chosen policy.

This section has described how tax discrimination arguments apply to the Spanish corporate and personal taxation systems and what implications such an approach has for the dividend paying behaviour of Spanish firms. The hypotheses that follow from this approach are not however, unique to this approach. In particular, other rationales exist that also give rise to such financial hierarchy/pecking order behaviour. The most influential of these is the pecking order model of Myers and Majluf (1984), in which adverse selection issues arise when the firm has more information about its value than providers of funds. These adverse selection issues are absent when retained earnings are used as the marginal source of funds and are greater for equity than debt finance. Providers of finance therefore require a risk premium which is greater for equity than debt finance. The result is that firms will have a preference for internal sources of funds followed by debt and then, when such sources are exhausted, equity finance will be used. This has a number of implications for the financial behaviour of firms. However, as a basis to an analysis of dividend behaviour it is less satisfactory than the tax discrimination arguments employed above since the pecking order model of Myers and Majluf (1984) offers little by way of a theory for the payment of a dividend. In fact, it is acknowledged by Myers (1984) that the pecking order model does not explain why companies pay dividends. Nevertheless, when companies pay dividends for other reasons, behaviour similar to that posited under the tax discrimination model (in terms of responses to cash flow and investment) should be expected (see also Fama and French (2002)).

The discussion of tax issues also neglects potential issues of signalling, where the payment of dividends is inferred as conveying positive information about the value of the firm. One of the main hypotheses that emerge from the signalling literature concerns the costs of adjusting dividends downwards implying that companies wish to maintain their dividends at a stable level. This therefore implies high adjustment costs and persistence in dividends which is one of the key hypothses to be examined directly below.

3 Estimation methods

Two estimation methods are employed. The first is a random effects probit model. This involves an auxiliary distributional assumption on the unobserved heterogeneity. The second approach is a linear probability model by Generalised Method of Moments (GMM) which, *inter alia*, investigates the sensitivity to this assumption.

3.1 Random effects probit model

The binary outcome, y_{it}, to be modelled is whether firm i omits a dividend in year t ($y_{it} = 1$) or not ($y_{it} = 0$). This is represented by the following:

$$y_{it} = 1\{\delta y_{it-1} + X_{it}\beta + \gamma_t + \alpha_i + \varepsilon_{it} > 0\} \tag{1}$$

where 'i' indexes companies $i = 2..N$ and 't' indexes years, $t = 1..T$. $1\{A\}$ is an indicator function of the event A. α_i denotes the unobserved company-specific component that is assumed random across companies with $\alpha_i \sim N(0, s_\alpha^2)$. $\varepsilon_{it} \sim (0, s_\varepsilon^2)$ represents random error and is assumed to be independent of α_i. α_i and ε_{it} are also assumed orthogonal to the set of covariates, X, with associated parameter vector β. The within-company correlation ρ, indicates the proportion of the total variance that is accounted for by the panel variance component, α_i. Under the testable restriction that $\rho = 0$, the model collapses to the pooled cross-sectional probit model. Estimation is by maximum likelihood.[11]

The inclusion of the lagged dependent variable, y_{it-1}, captures any tendency that may exist for companies that have paid a dividend in one year to continue to do so, perhaps for signalling reasons. Heckman (1981a) distinguishes between 'pure' and 'spurious' state dependence. Pure state dependence refers to the act of having made a dividend payment/omission last year increasing the subsequent probability of doing so and would be consistent with the argument of Lintner (1956). Spurious state dependence reflects the point that companies may differ, in unobservable ways that are persistent, in their propensity to experience the event. We attempt to control for the latter through the random effects term, and by conditioning on relevant financial characteristics, X.

However, estimation of the model requires an assumption concerning the first observations, y_{i1}, in particular regarding their relation with the unobserved heterogeneity α_i. The assumption that this is exogenous might be appealing when the first observation relates to the beginning of the underlying process. In the present context, the justification for this assumption is unclear and we therefore wish to investigate the sensitivity of the results to relaxing this assumption. When the initial condition, y_{i1} is correlated with the unobservables α_i, this will lead to an upward bias in the extent of persistence in dividend policies. Nevertheless, the resulting bias when the initial condition is not exogenous declines as the number of time-series observations increases. In the present context, where we have a relatively large T, the bias resulting from treating the initial conditions as exogenous may not be too problematic.[12] The second estimation approach considers this potential sensitivity more formally.

3.2 Dynamic linear probability model by GMM

The assumed absence of any correlation between the unobserved heterogeneity and both the regressor set and the error term might seem strong. These assumptions as well as the initial conditions problem referred to above can be relaxed by estimating a linear probability model by GMM which takes the following form:

$$y_{it} = \phi y_{it-1} + X_{it}\theta + d_t + f_i + \omega_{it} \tag{2}$$

where the notation follows from that above, but in this case the unobserved heterogeneity represented by the fixed effects f_i are fixed parameters rather than drawn from a distribution under the random effects assumption. Common time effects are represented by d_t. First-differencing removes the company-specific effects, f_i.

$$\Delta y_{it} = \phi \Delta y_{it-1} + \Delta X_{it}\theta + \Delta d_t + \Delta\omega_{it}$$

The first-differencing induces a correlation between Δy_{it-1} and $\Delta\omega_{it}$ such that instrumentation becomes necessary to avoid a downward bias on ϕ (Nickell, 1981), whilst the assumption of exogeneity of the regressors X can also be relaxed. A number of instrumental variable estimators have been proposed in the literature. A popular technique is that of Arellano and Bond (1991) who derive a Generalised Method of Moments (GMM) estimator, involving an increasing number of instruments beginning at $t-2$ as t increases. This is based on the moment conditions

$$E\left(Z_{it-s}\Delta\omega_{it}\right) = 0$$

for $t = 3, ..T$ and $s \geq 2$, where $Z_{it} = (y_{it-1}X_{it})'$.

Consistency of the Arellano and Bond (1991) estimator requires the absence of second-order serial correlation in the first differenced residuals and they propose a test statistic for this hypothesis reported below. Also reported is a standard Sargan test of over-identifying restrictions although Blundell *et al.* (2000) report Monte-Carlo evidence showing that the Sargan test of the overidentifying restrictions for the estimator employed below tends to over-reject, especially when the number of observations per company is large and there is a high degree of persistence. A further appealing feature of the linear probability model relative to the (random effects) probit is that the point estimates (and robust standard errors) are robust to the presence of heteroskedasticity.

In such cases where there is a high degree of persistence in the data such that lagged levels have a low correlation with the first difference, this standard linear GMM estimator has been found to suffer from a 'weak instruments problem' displaying poor finite sample properties. Arellano and Bover (1995) propose an estimator that considers the equation in levels, with lagged first-differenced terms as instruments as well as the lagged level terms as instruments in the first-difference equation. This is examined in detail by Blundell and Bond (1998) who illustrate the significant asymptotic efficiency gains in this GMM-System estimator. A sufficient condition for the validity of the additional moment restrictions is stationarity. Below, results obtained from this estimator are presented as well as those from the random effects probit model described above. Linear probability of this kind provide consistent estimates of the parameters even when applied to binary data and indeed have proved increasingly popular in other applications such as those considered by Chay and Hyslop (1998) and Hyslop (1999).[13]

4 Data and Estimation Results

4.1 The Data

This paper employs data derived from the Annual Central Balance Sheet Database (Central de Balances, CBA) of the Banco de España. This consists of a voluntary, large-scale survey of non-financial companies in Spain. Its coverage of the non-financial sector is around 35 per cent in each year by value added of the non-financial Spanish corporate sector.[14] The present analysis selects on a minimum of 10 employees and a minimum of four continuous time-series observations per company. A small number of other data consistency checks were also carried out and outliers eliminated. The resulting dataset consist of 7,815 companies over the period 1985 to 2000. Also examined is a subset of the data which consists of those 2,347 companies with mean employment during the sample period of at least 100. Also presented are a limited set of results based on the subsample of Spanish companies that are quoted.

4.2 Data description

Figure 1 illustrates the proportion of dividend-omitting companies in the sample of Spanish non-financial companies. In order to avoid variation associated in the sample proportions owing to companies entering and leaving the sample, the figure illustrates the case of the balanced panel of companies present in every year over the 1985 to 2000 period. In addition to illustrating the profile of overall dividend omission, a distinction is also made between those companies that omit a dividend but had previously paid a dividend (ie. in their available history up to that year) known as 'former-payers' and those that have never paid a dividend.

The aggregate degree of incidence of dividend omissions appears counter-cyclical or at least an increase in omission is witnessed in the recession of 1993. This is the first indication that dividend omission may be related to financial pressure experienced by firms. Moreover, the distinction between those companies that omit a dividend and were former-payers and those that have never paid a dividend is informative. In the first year of the sample, all of those that omit a dividend must be 'never-payers' (in their available history), but as we proceed through the panel we see that the proportion of those that have never-paid declines as companies start to pay a dividend for the first. The figure also shows that most of the increase during the recession is accounted for by former-payers, perhaps attempting to repair their balance sheets. There is some suggestion of a reduction in the overall rate of omission, particularly in the incidence of companies that have previously paid a dividend coinciding with the 1995 tax change that reduced (but did not eliminate) the tax cost of paying dividends in Spain. This pattern is also present in the total sample. In 1994, the rate of omission was 78.4 per cent but declined to 73.5 per cent by 1996 then falling to less than 70 per cent by 2000. In the balanced panel shown in Figure 1, the overall rate of omission declined from 68.7 per cent in 1994 to 57.7 per cent by 1996, remaining stable until 2000.

Omission is quite high among the sample of Spanish firms: 68.8 per cent of the Spanish sample observations involve dividend omission. Even in the sub-sample of (20,989) observations consisting of Spanish companies with at least 100 employees, the rate of omission is 60.1 per cent. Among the 1,892 observations for quoted Spanish companies, the rate of omission is 33.0 per cent. Benito and Young (2001) note that the rate of dividend omission among quoted UK firms is 25.2 per cent in 1999.

Table 1 presents median values on the main financial characteristics of interest for the set of Spanish firms. These figures are split according to whether the company-year observation involves a dividend omission ($D = 0$) or payment ($D > 0$) and also whether the company has cut the dividend ($\Delta D < 0$).[15] The typical dividend-omitting company has lower cash-flow, higher indebtedness and is smaller than the typical dividend-paying company. The median investment rate is also lower among dividend-omitting firms. The median dividend-paying company has a level of turnover twice that of the median dividend-omitting company. Dividend omission also tends to be associated with notably higher figures for the borrowing ratio term, br, defined as the ratio of interest payments to cash flow. These same patterns also hold for the sample of large firms with at least 100 employees. A final column in Table 1 presents typical characteristics of companies that never-pay a dividend during the sample period. These companies have relatively low cash flow (and lower than dividend omitters overall), higher rates of investment (again higher than the $D = 0$ sample). They also have particularly high levels of indebtedness and debt-servicing costs and are smaller in size than all dividend-omitting companies.

As an indication of the degree of persistence in individual companies' propensity to omit or pay a dividend, Table 2 considers those companies that are present in the survey for 6 consecutive years and illustrates their sequences of dividend omissions versus dividend payments. The table indicates a high level of persistence. Just over one-half of these companies never make a dividend payment. In the sample overall, 44.3 per cent of companies never post a dividend during the period for which they are in the sample, which varies between 4 and 16 years (see Data Appendix). For these companies it seems highly unlikely that they can use the dividend as a response to financial pressure. More generally, the high degree of persistence in the company's policy of paying or omitting a dividend is suggested by the higher frequency of sequences which involve a run of omissions or payments compared to those which have intermittent switches between the two statuses. Of course this raw inspection of the data does not control for financial situation of the company, unobservable characteristics or the initial condition.

4.3 Estimation results

We begin with estimates based on the random effects probit models and then consider linear probability models by GMM. The basic specification considers the propensity to omit the dividend as a function of cash flow (CF/K), investment (I/K), net indebtedness ($(B-C)/K$) and a control for the scale of the company (log real sales, $logS$). The response to short-term financial pressure associated with servicing debt is considered through the inclusion of the borrowing ratio term (br), in place of the net indebtedness term. All regressors are lagged one year. A further extension is to consider a role for persistence through the inclusion of the lagged dependent variable (y_{it-1}). All specifications also include a full set of year dummy variables to control for aggregate movements common across companies.

Random effects probit estimates

The results accord with our priors based on the discussion in section 2. The propensity to omit the dividend is inversely related to the cash flow of the firm. This is consistent with the financing of investment at the margin from retained funds, with the residual being distributed as a dividend. In the specification reported in column 1 of Table 3, the cash flow term (CF/K_{it-1}) attracts a coefficient (standard error) of -0.354 (0.014). The marginal effect associated with this term, at -0.065, indicates that a 10 percentage point increase in cash flow reduces the probability of an omission by 0.007, or a little more than half a percentage point. The estimates also indicate a positive relation between the propensity to omit a dividend and investment. This provides support for the relation highlighted by Auerbach and Hassett (2002) and also found in the context of a smaller cross-section of Spanish firms by Arrazola *et al.* (1992). These results therefore provide support for the two key implications of the tax discrimination/financial hierarchy model.

There is also evidence that dividends play a significant role in adjusting the balance sheet in response to high levels of debt. The gearing term ($(B-C)/K_{it-1}$) is significantly positive with a coefficient (standard error) of 0.114 (0.008). A higher level of debt implies a commitment to a higher stream of interest payments and a reduced probability of paying a dividend, with the dividend omission helping maintain debt on a sustainable path. This inverse relation between dividend payment and debt is also consistent with the use of the dividend as a response to balance sheet pressures. Lozano *et al.* (2002) also find evidence of an inverse relation between dividends and debt in a sample of 102 quoted Spanish firms. They interpret this as suggesting that dividends represent an alternative to the use of debt as a means of responding to agency problems. From this basic specification it is also found that larger companies are significantly less likely to omit a dividend, controlling for the noted observable characteristics and unobservable characteristics through the random effects.

In column 2, the borrowing ratio term br_{it-1} is included. Since debt-servicing costs are themselves a function of the amount of debt, column 2 omits the debt term $((B-C)/K_{it-1})$ from the specification, whilst column 3 includes both terms; both specifications also control separately for cash flow. The results provide evidence that companies also respond to financial pressure by being more likely to omit a dividend payment. This extends the range of responses to financial pressure considered by Nickell and Nicolitsas (1999) in the case of quoted UK firms. Indeed the marginal effects suggest that this is clearly the characteristic to which the propensity to omit a dividend is most sensitive. A 10 percentage point increase in interest payments increases the probability of omitting a dividend by 0.04.

In column 4, the lagged dependent variable, (y_{it-1}) is introduced. This is the preferred specification, subject to the possible concerns regarding the inclusion of a lagged dependent variable in a random effects model which does not control for initial conditions–an issue considered below. The lagged dependent variable is highly significant, indicating that controlling for financial characteristics and the unobservables, there is a significant degree of persistence in the dividend policies of Spanish firms. The act of omitting a dividend in one period appears to, in itself, increase the probability of omitting a dividend again in the subsequent period. Moreover the quantitative effect is very large. The change in the probability of omission is estimated as 0.485 (Table 4), which compared to an overall proportion of omission of 0.688, is a large effect. Controlling for y_{it-1}, the sign and significance of the financial characteristics described previously remain intact and in fact vary relatively little when including the lagged dependent variable

Linear probability models by GMM

The linear probability models, estimated by GMM are now considered (Table 5). As discussed in section 2, these models relax a number of distributional assumptions, notably exogenous initial conditions, homoskedasticity, and strict exogeneity of the regressors, required for consistency of the dynamic random effects probit estimates. The results, reported in Table 5, display a similar pattern to those under the random effects probits discussed above.

The propensity for companies to omit a dividend is inversely related to the firm's cash flow, with a statistically significant coefficient (robust standard error) of -0.045 (0.004). The investment term also attracts a significantly positive coefficient, at 0.013 (0.004), indicating that an increase in investment tends to lead to a reduction in the dividend consistent with the presence of a financial hierarchy.

Importantly, the GMM estimates continue to indicate the presence of high levels of persistence in dividend policies, one of the key results. Partly owing to the presence of serial correlation, but also due to the high degree of persistence estimated in these models, a second lag of the dependent variable was added, y_{it-2} .[16] The results indicate that this is highly significant, and positively signed even controlling for the first lag of the dependent variable. In the results which include the borrowing ratio term br_{it-1}, the second lag of omission y_{it-2} attracts a coefficient (robust standard error) of 0.081 (0.008).

Throughout these results, increases in sales are estimated to be associated with a reduced propensity to omit a dividend. However, one difference between the LP GMM estimates and those under the RE probit concerns the role of underlying indebtedness which does not emerge as significant under the LP GMM estimates in Table 5. Nevertheless, the financial pressure associated with servicing debt continues to be highly significant as it was under the RE probit estimates above. The borrowing ratio term br_{it-1} attracts a coefficient (robust standard error) of 0.197 (0.012) in the estimates in column 4 which also continue to show an inverse relation between the propensity to omit a dividend and cash flow, and positive relation with the firm's investment.

Comparing the marginal effects under the RE probit (Table 4) with the coefficients (which are also marginal effects) under the LP estimates reveals a close correspondence between the two. For the same specification in column 5 of each table, a marginal effect under the RE probit associated with the cash flow term CF/K_{it-1} of -0.046 compares to that of -0.042 obtained under the linear probability model. The marginal effect declines slightly from 0.038 to 0.018, with a larger decline apparent for the estimated borrowing ratio term, the estimated marginal effect declining from 0.394 to 0.188, but remaining highly significant and continuing to suggest that quantitatively the financial characteristic to which dividend omission is most sensitive is the burden of servicing debt relative to cash flow. Given the number of assumptions which are altered between the two sets of specifications, the results can be said to be rather robust in the light of these sets of results.

Sub-sample evidence

Subsamples of the data are now considered. First, the sample is restricted to those companies whose (average) employment is at least 100 during the sample period. The sample is then restricted to those publicly traded on the Spanish exchange. The restriction to relatively large companies reduces the sample to 2,347 companies (18,642 observations). The rate of omission among these data is 60.1 per cent.

The results re-enforce those previously found, suggesting that the evidence from the Spanish data do not result simply from the relatively large number of small companies. In the specification that includes the indebtedness term $((B-C)/K_{it-1})$, and borrowing ratio term br_{it-1} the cash flow (CF/K_{it-1}) term is significant suggesting that a dividend omission is significantly less likely as cash flow increases. The addition of the second lag in the dividend omission state again attracts a significantly positive coefficient in the case of the Spanish sample, with an almost identical coefficient to that estimated for the whole sample of Spanish firms. The other results from previously again carry over such that the specifications which include the second lag of omission represents the preferred specifications for the sample of larger Spanish firms. The coefficients are also rather close to those previously described for the complete sample of Spanish firms. In the case where the financial pressure term br_{it-1} is employed, this attracts a coefficient (robust standard error) of 0.263 (0.022). These compare to an estimate of 0.197 (0.012) for the whole sample results.

In the case of quoted Spanish companies, owing to the significant reduction in observations (to 239 companies and 1,638 observations), linear probability models with standard fixed effects methods are estimated rather than by GMM and this specification therefore omits the lagged dependent variable. The results indicate that among Spanish quoted companies the probability of not paying a dividend is significantly declining in the cash flow of the company and increasing in the indebtedness of the firm, both familiar results from our previous estimates.

It might also be felt that companies that have never paid a dividend are sufficiently different from most companies that they should be excluded from the analysis. The propensity for a former-paying company to omit a dividend was considered separately, with results proving very similar to those across the entire sample. The predicted probabilities among those that omit for the two types of omission can also be compared with the mean predicted probability among the former-payers being 0.832 and that among the never-payers of 0.847 under the specification of Table 3 column 1. The ability of the model to account for the behaviour of those that have never paid a dividend seems in line with its ability to account for dividend omission in general.

Random effects Tobit models

As a set of final experients for examining the dividend distributions of Spanish firms, information regarding the level of payment is exploited. The specifications here follow from those considered above, although the lagged dependent variable is not considered since the regressors are assumed strictly exogenous. The results for these Type I Tobit models with random effects are shown in Table 7.

The results accord with the previous pattern of results obtained. Dividends are increasing in the level of cash flow of the firm and declining in the level of investment. These terms are highly significant with the lagged cash flow term attracting a highly significant and positively signed coefficient and that on lagged investment attracting the predicted negative coefficient. Moreover, in these results there is also evidence of an inverse relation between dividends paid and the amount of indetedness of the firm, with the net debt term $(B - C)/K_{it-1}$ attracting a significantly negative coefficient. In the second specification shown, the financial pressure term br_{it-1} is considered in place of the net debt term and this also is highly significant and negatively signed. This further supports the view that firms respond to financial pressure by reducing the level of dividend offered to shareholders. Dividends are also larger for larger firms. The results shown in Table 7 indicate that this pattern of results also holds for the larger sample of firms, with the cash flow and investment effects estimated as slightly larger.

5 Conclusion

This paper has examined company financial policies in the form of their decision to omit versus pay a dividend, as well as the level of dividend paid. This has been carried out using Spanish company-level data from the Central de Balances of the Banco de España for the period 1985 to 2000. The analysis has produced several novel results.

First, not surprisingly, aggregate incidence is counter-cyclical, increasing in the recession in 1993. The notion that dividend adjustment is a response to financial pressure, suggested by such an aggregate pattern, was then supported at the micro-level as binary panel data models were estimated for the incidence of dividend omissions in Spain. These models included a role for the financial pressure associated with debt-servicing costs, the preferred measure of financial pressure highlighted by Nickell and Nicolitsas (1999). The results thereby extend the range of corporate responses to financial pressure such as in the form of employment, wage growth and productivity effects considered by Nickell and Nicolitsas (1999), whilst investigating this impact for firms in Spain.

Second, despite the general use of the dividend payment as a response to financial pressure, it is also clear that for a large proportion of companies they are unable to respond to financial pressure in this way as almost one-half of the sample firms *never* make a dividend payment during the sample period and therefore cannot reduce the dividend further. The model explains the behaviour of those companies that never pay a dividend by the same combination of variables, noting that these companies are especially small, have lower cash flow, higher rates of investment and particularly high levels of debt and debt-servicing costs.

Third, the 'new view' tax discrimination model of corporate finance (eg. Auerbach, 2001) and its application to Spain has been discussed. The model can be used to justify a hierarchy of finance with internal funds the preferred marginal source of funds. Estimation results are consistent with these implications, most notably as the propensity to omit the dividend is inversely related to the cash flow of the company and positively related to the investment of the firm. It is consistently found that smaller companies are less likely to omit a dividend controlling for other characteristics in both countries. Moreover the same predictions find support when looking at the level of dividend paid.[17]

Fourth, the degree of persistence in the discrete dividend decision has been considered. Dividend policies are highly persistent. The propensity to omit a dividend increases by around 0.40 among Spanish firms according to whether the firm omitted a dividend in the previous year. Moreover, the econometric models have paid special attention to controlling for unobservables and the potential initial conditions problem. Such high degrees of persistence after controlling for observable financial characteristics, firm-specific unobservables and initial conditions, suggests that the act of paying a dividend in one year in itself affects the probability of paying a dividend subsequently. This notion, consistent with that of Lintner (1956), suggests that costs of adjusting dividends are high which may be consistent with some forms of dividend signalling-type effects. It also indicates that balance sheet adjustment is slowed down by such concerns raising the possibility that adjustment will be made through some other, perhaps non-financial, means in response to such factors as temporary cash flow shocks.

Notes:

1. Fama and French (2001) for instance, note that "dividends have long been an enigma". This is particularly the case outside the United States where more limited evidence to date exists.

2. See also Poterba and Summers (1985) for a discussion and application to UK data. Auerbach (2001) contains a critique of the Poterba and Summers (1985) attempt to discriminate between the 'new view' and other approaches to the effects of dividend taxation.

3. Note that strictly this should be the effective, accrual-based, capital gains tax rate, rather than that on realisation. This is lower than the rate of tax on realisation of capital gains (see King, 1977).

4. Carpenter and Petersen (2002) cite estimates of the direct costs of raising equity capital, f, in the form of underwriting and administrative costs, of around 0.10 and are likely larger for smaller firms. Including the effects of equity issuance on equity prices that result from information asymmetries, raises the value of f to around 0.30.

5. When informational problems are present firms of course, may distribute dividends and issue equity at the same time. This study does not examine new equity issues explicitly (see Benito and Young (2002) for a study of UK companies' new equity issuance).

6. This was clearly the case until 1999 as the rate of capital gains tax was the individual's average income tax rate.

7. Taking account of borrowing does not substantially change these conclusions. When there is a tax disadvantage to dividend payments, companies could use any excess cash flow to build up assets or run down debt instead of paying dividends, but this would merely postpone the question of how to avoid the dividend tax. In fact, optimal indebtedness is also a function of relative tax rates and dividend constraints (see also Bond and Meghir, 1994).

8. Investment opportunities facing the firm, commonly proxied by an average Tobin's Q variable, would also be a natural candidate. However, since most of our Spanish companies below are non-quoted this is not possible. Benito and Young (2001) report results for UK firms which include this variable.

9. Fudenberg and Tirole (1995) present a model of dividend smoothing based on managers' concerns about retaining their positions where dividends may act as a signal of future income.

10. Defining the flow borrowing ratio as $br = rB/CF$, where r is the company-specific average rate of interest paid on debt, B is the stock of debt and CF is cash flow, it should be clear that the variable picks up variation in each of these components.

11. See STATA manual (StataCorp, 2001) or Arulampalam (1999) for the likelihood function. A normalisation is required for estimation, with the standard one that $\sigma_\varepsilon^2 = 1$ adopted here.

12. Heckman (1981b) proposed a solution to this initial conditions problem involving a reduced form for y_{i1}. However, estimation requires identifying variables that are unique to this equation. This is likely to depend on pre-sample information

that can be convincingly excluded from the basic model (1). In the present context, the absence of any appealing condidates means that estimating a model of this kind has not been pursued.

13. See also Arellano (2000) and Bover and Arellano (1997) for a review of panel data models using the probit or logit assumption as well as Chay and Hyslop (1998).

14. Further details of the Spanish database are provided in Banco de España (2000).

15. Owing to skewness in many of the variables, the medians are considered more informative than the means. Note also that firms with accounting losses are treated in the same way as those without losses.

16. The estimates which include y_{it-2} show no signs of being subject to second-order serial correlation. Although the Sargan test returns a significant test statistic, Monte Carlo evidence of Blundell *et al.* (2000) shows that this test rejects the null particuarly where T is relatively large as it is here. Hence relatively little weight is attached to the Sargan test results. Using instruments dated from $t-3$ and $\Delta t-2$ showed a very similar pattern of results with a minor increase in the standard errors. Nickell and Nicolitsas (1999) report significant Sargan test statistics for all of their regession results.

17. Although these predictions are consistent with other rationales for a hierarchy of finance (eg. Myers and Majluf, 1984), since this pecking order model based on asymmetric information does not explain why companies might pay a dividend in the first place, attention has focused on the tax discrimination rationale.

Table 1: Sample medians

		all firms			large firms			
		$D = 0$	$D > 0$	$\Delta D < 0$	$D = 0$	$D > 0$	$\Delta D < 0$	never-pay
CF/K	cash flow	0.064	0.195	0.122	0.038	0.160	0.099	0.061
I/K	investment	0.085	0.103	0.092	0.081	0.106	0.096	0.111
B/K	gross debt	0.595	0.353	0.404	0.558	0.343	0.388	0.837
$(B-C)/K$	net debt	0.460	0.193	0.258	0.477	0.246	0.303	0.636
br	borrowing ratio	0.279	0.100	0.158	0.292	0.110	0.164	0.364
S	sales (E000, 1995 prices)	5,134.0	10,076.9	8,656.7	23,457.3	34,776.1	31,198.79	3,745.4
n	observations	44,412	20,140	8,831	12,607	8,382	3,461	2,983

Note: See Data Appendix for variable definitions.

Table 2: Sequences of dividend omissions

Sequence	companies	Sequence	companies
000000	78	111111	492
000001	24	000111	19
000010	5	001110	5
000100	7	011100	0
001000	5	111000	15
010000	5		
100000	2	001111	14
		011110	3
000011	19	111100	13
000110	1		
001100	3	011111	33
011000	5	111110	17
110000	15	others	158

Note: The table illustrates the frequency of sequences among the 938 firms that are present in the panel for 6 years. A '1' indicates a dividend omission in that year of the sequence and a '0' indicates a positive dividend payment.

Table 3: Random effects probit estimates for dividend omission

	[1]	[2]	[3]	[4]	[5]
y_{it-1}				1.652 (0.022)	1.570 (0.022)
CF/K_{it-1}	-0.354 (0.014)	-0.241 (0.014)	-0.237 (0.014)	-0.251 (0.011)	-0.177 (0.011)
I/K_{it-1}	0.153 (0.022)	0.170 (0.022)	0.166 (0.023)	0.124 (0.020)	0.143 (0.020)
$(B-C)/K_{it-1}$	0.114 (0.008)		0.014 (0.009)	0.080 (0.007)	-0.001 (0.007)
br_{it-1}		2.122 (0.046)	2.106 (0.047)		1.500 (0.050)
$\log S_{it-1}$	-0.373 (0.012)	-0.329 (0.013)	-0.330 (0.013)	-0.164 (0.008)	-0.164 (0.008)
log-likelihood	-23,170.846	-21,969.403	-21,968.245	-20,489.595	-19,599.053
ρ	0.708 (0.005)	0.696 (0.006)	0.696 (0.006)	0.276 (0.014)	0.287 (0.013)
companies	7,815	7,815	7,815	7,815	7,815
observations	56,743	56,743	56,743	56,743	56,743

Notes: Maximum likelihood estimates for random effects probit model. ρ is the proportion of the total variance accounted for by the company-specific component. Standard errors in parentheses. All specifications also include a full set of year effects.

Table 4: Marginal effects from RE probits

	[1]	[2]	[3]	[4]	[5]
y_{it-1}				0.485	0.450
CF/K_{it-1}	-0.065	-0.044	-0.043	-0.069	-0.046
I/K_{it-1}	0.028	0.031	0.030	0.034	0.038
$(B-C)/K_{it-1}$	0.021		0.002	0.022	-0.000
br_{it-1}		0.384	0.381		0.394
$\log S_{it-1}$	-0.069	-0.060	-0.060	-0.045	-0.043

Note: Marginal effects for the continuous regressors, evaluated at the means, are calculated as $\frac{d[prob(y=1|x)]}{dx_k} = \phi\left(\overline{x}\beta\sqrt{1-\rho}\right)\left(\sqrt{1-\rho}\beta_k\right)$ where $\phi(\cdot)$ is the standard normal density function, $\overline{x}$ is the vector of mean characteristics, β the vector of coefficient estimates with β_k the coefficient estimate on regressor x_k (see Arulampalam (1999) on the adjustment to the standard expression for marginal effects by the $\sqrt{(1-\rho)}$ correction factor in a random effects probit model). For the lagged dependent variable, y_{it-1}, the marginal effect is calculated as the change in the predicted probability for a discrete change in y_{it-1}.

A 1-unit change in a financial ratio represents a 100 percentage point increase.

Table 5: Linear probability models by GMM

	[1]	[2]	[3]	[4]	[5]
y_{it-1}	0.353 (0.009)	0.344 (0.009)	0.411 (0.010)	0.398 (0.010)	0.395 (0.010)
y_{it-2}			0.088 (0.008)	0.081 (0.008)	0.081 (0.008)
CF/K_{it-1}	-0.045 (0.004)	-0.034 (0.004)	-0.056 (0.005)	-0.030 (0.007)	-0.042 (0.005)
I/K_{it-1}	0.013 (0.004)	0.013 (0.004)	0.018 (0.005)	0.013 (0.005)	0.018 (0.005)
$(B-C)/K_{it-1}$	0.001 (0.003)		0.004 (0.003)		0.002 (0.003)
br_{it-1}		0.161 (0.010)		0.197 (0.012)	0.188 (0.011)
$\log S_{it-1}$	-0.090 (0.007)	-0.067 (0.006)	-0.084 (0.007)	-0.056 (0.007)	-0.056 (0.007)
M_2	0.000	0.000	0.066	0.212	0.208
Instruments	t-2...t-4; Δt-1	t-2...t-4; Δt-1	t-2...t-4; Δt-1	t-2...t-4; Δt-1	t-2...t-4; Δt-1
Sargan	0.000	0.000	0.000	0.000	0.000
companies	7,815	7,815	7,815	7,815	7,815
observations	56,743	56,743	48,928	48,928	48,928

Notes: Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions (p-value reported). M_2 is a test of second-order serial correlation in the first-differenced residuals (p-value reported). Asymptotic robust standard errors reported in parentheses. All specifications also include a full set of year effects.

Table 6: Subsample evidence

	large firms (employment $\geq$ 100)					quoted firms			
	LP GMM	LP GMM	LP GMM	LP GMM	LP GMM	RE probit	RE probit	FE LP	FE LP
y_{it-1}	0.396 (0.016)	0.375 (0.015)	0.441 (0.016)	0.411 (0.016)	0.408 (0.016)	2.044 (0.135)	1.876 (0.145)		
y_{it-2}			0.086 (0.013)	0.080 (0.013)	0.081 (0.013)				
CF/K_{it-1}	-0.071 (0.009)	-0.050 (0.008)	-0.080 (0.014)	-0.058 (0.013)	-0.065 (0.011)	-3.738 (0.487)	-2.395 (0.508)	-0.397 (0.047)	-0.197 (0.047)
I/K_{it-1}	0.025 (0.010)	0.028 (0.010)	0.014 (0.013)	0.023 (0.013)	0.026 (0.013)	0.042 (0.444)	0.707 (0.467)	-0.145 (0.062)	0.017 (0.060)
$(B-C)/K_{it-1}$	0.008 (0.006)		0.018 (0.008)		0.012 (0.007)	0.525 (0.116)	0.192 (0.131)	0.047 (0.024)	-0.037 (0.023)
br_{it-1}		0.236 (0.019)		0.263 (0.022)	0.255 (0.020)		1.554 (0.265)		0.531 (0.039)
$logS_{it-1}$	-0.076 (0.017)	-0.040 (0.014)	-0.064 (0.016)	-0.025 (0.014)	-0.029 (0.014)	-0.178 (0.043)	-0.208 (0.048)	-0.066 (0.024)	-0.024 (0.023)
log-likelihood						-467.234	-446.576		
R-squared								0.142	0.285
ρ						0.237 (0.089)	0.314 (0.093)		
M_2	0.00	0.00	0.871	0.622	0.702				
Sargan	0.00	0.00	0.032	0.004	0.007				
companies	2,347	2,347	2,347	2,347	2,347	239	239	239	239
observations	18,642	18,642	16,295	16,295	16,295	1,638	1,638	1,638	1,638

Note: LP GMM denotes LP models estimated by GMM, RE probit are random effects probit model estimates and FE LP are fixed effects linear probability results.

Table 7: Dividend distributions

	all firms		large firms	
CF/K_{it-1}	0.350 (0.005)	0.333 (0.005)	0.485 (0.015)	0.424 (0.015)
I/K_{it-1}	-0.248 (0.010)	-0.263 (0.010)	-0.348 (0.032)	-0.372 (0.032)
$(B-C)/K_{it-1}$	-0.045 (0.003)		-0.045 (0.010)	
br_{it-1}		-0.696 (0.020)		-0.990 (0.042)
$\log S_{it-1}$	0.122 (0.006)	0.108 (0.005)	0.127 (0.011)	0.115 (0.011)
log-likelihood	-32,392.567	-31,794.906	-11,782.488	-11,493.104
ρ	0.548 (0.007)	0.532 (0.007)	0.335 (0.005)	0.292 (0.005)
companies	7,815	7,815	2,347	2,347
observations	56,743	56,743	18,642	18,642

Notes: Table reports results from random effects Tobit models for dividend distributed, normalised on fixed assets. ρ denotes the proportion of the total variance accounted for by the random effects unobservable component.

Data Appendix

The structure of the panel in terms of the number of observations per company is the following.

Table A.1: Structure of panel

no. of records	4	5	6	7	8	9	10
companies	1,356	1,241	938	701	575	442	318
no. of records	11	12	13	14	15	16	total
companies	347	352	370	377	261	537	7,815

Further details of the dataset can be found in Banco de España (2000). Below, the construction of the variables in the analysis is described.

Dividends (D)
Ordinary dividends paid.

Capital stock (K)
Capital stock is measured at replacement cost by a perpetual inventory method used by the Bank of Spain Central Balance Sheet Office (Banco de España, 2000).

Investment (I)
Purchase of new fixed assets.

Cash flow (CF)
Profit after tax and interest payments plus depreciation of fixed assets.

Borrowing ratio (br)
Interest payments divided by profit before tax. Cases where the denominator is negative are recoded to equal one.

Gross indebtedness (B/K)
Total debt divided by capital stock.

Net indebtedness $((B-C)/K)$
Total debt less cash and equivalent divided by capital stock.

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Figure 1: Balanced panel